Effects of Cold on Vehicles

Terminal Learning Objective:

Action: Operate vehicles in the cold weather environment

Condition: In temperatures of 32º F to -60 ºF, given the requirement to maintain and operate a military vehicle, and the correct technical manual and lubrication orders for the vehicle.

Standard: Identify the common problems with cold weather vehicle operation. Take steps to reduce or eliminate problems caused by the cold before, during, and after operations.

Cold Conditions

COLD- few problems down to 10°F; for temperatures 10° to -25°F special considerations for operations such as winterization of vehicles; below -25°F routine tasks become complex

CONDENSATION- occurs when cold equipment is quickly exposed to a warmer environment

SNOW- introduces moisture to equipment and causes mobility problems; increases equipment loss

FROZEN SURFACES- hinders emplacement of stakes, grounding rods; creates unstable firing platforms; possible contact frostbite

Effects on Materials

METALS- brittle in severe cold; at -20°F certain metals (especially steel) can't withstand a shock load

RUBBER- remains flexible until below -20°F

RUBBER COVERED CABLES- easily cracked at low temp; should be re-warmed before bending

PLASTICS- generally expand and contract more than metals

GLASS- windshields may crack if heat is applied too rapidly

FABRICS- retain flexibility if kept dry; shrinkage can occur

Maintenance Plans

Maintenance plans must include:

- **Shelter to sized to accommodate equipment**
- **Portable heaters and lighting**
- **PPE for maintenance personnel**
- **Repair parts on hand**
- **Storage for fluids**
- **Snow and ice removal**

Plan on lag time for equipment to thaw before being serviced.

Recovery assets will become vital

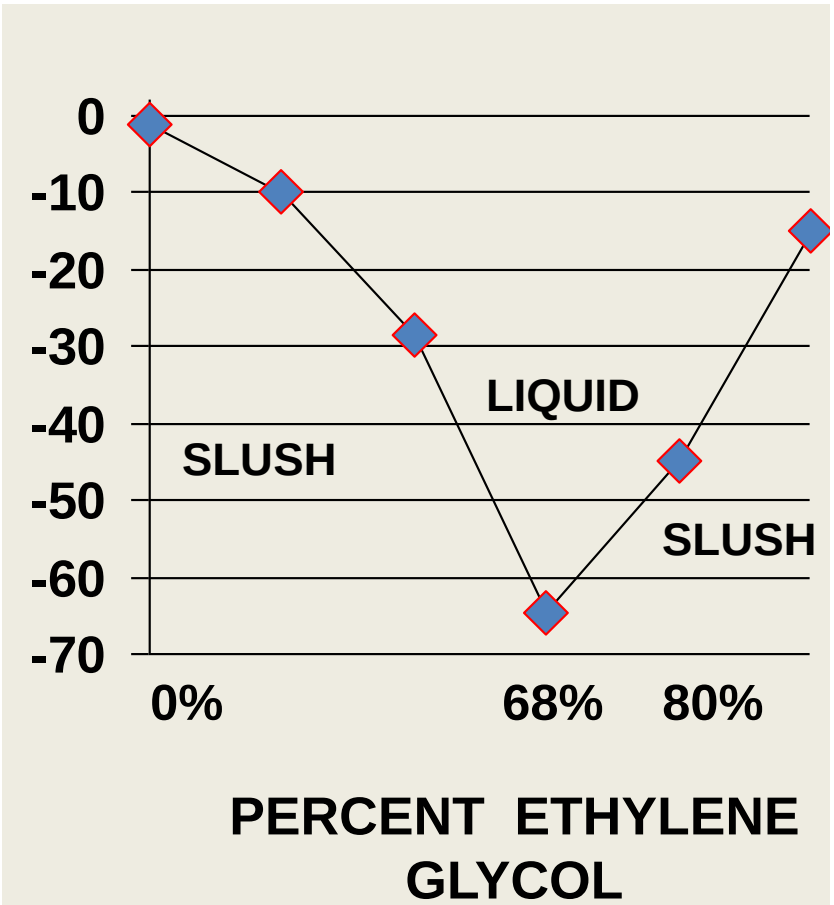
USARAK 750-1

Antifreeze

Ethylene-Glycol must be mixed to a proportion of water to be effective; 68% antifreeze and 32% water is optimum.

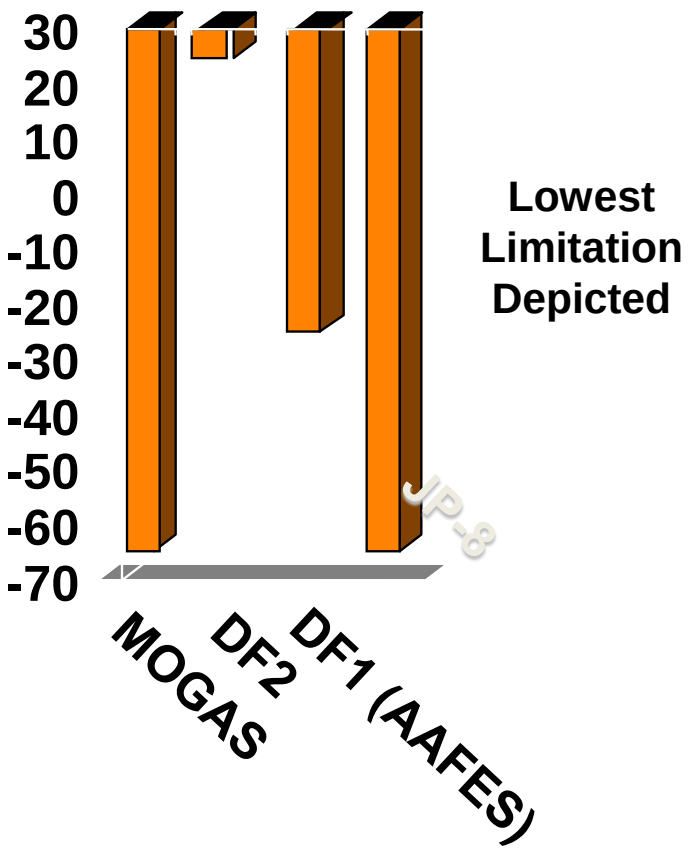
Use of a block heater is important as ice crystals will begin to form at -40°F

Arctic type antifreeze protects to -90°F



Fuels

- MOGAS is not affected significantly by low temp
- Diesel fuel is greatly changed by the formation of waxes
- Condensation can contaminate fuel and turn into ice crystals
- Additives can inhibit icing
- The Army is going to a single fuel source; this fuel source is JP-8; JP-8 does not need additives above -53 F
- Ether or similar spray can fluids are prohibited.



LUBRICANTS

USARAK Regulation 750-4 governs what lubricants will be used in vehicles and weapons systems.

LUBRICANTS

Engines will use Oil, Engine, Synthetic, OEA, 0W30 year round unless specified otherwise by manufacturer.

Transmissions, gear cases and hydraulic and power steering systems use OEA 0W30.

- **OEA is compatible with all transmission fluids including Dexron III.**
- **Can be mixed with other types of fluids.**

Caterpillar transmissions use 15W40

Allison (FMTV) transmissions use OEA only

LUBRICANTS

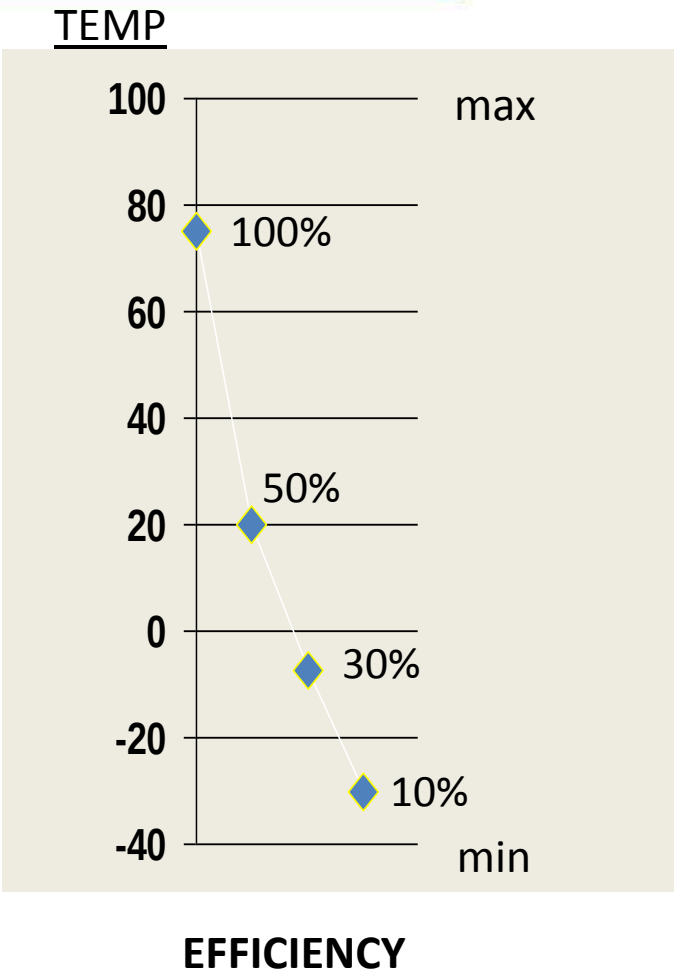
Manual transmissions, transfers, differentials and final drives use Oil, Gear 75/90 Synthetic

- **HEMTT and HMMWV transfer cases use OEA**

Chassis and wheel bearing lubricant is Grease Automotive and Artillery (GAA)

Vehicle Batteries

- Batteries are adversely affected by cold; as the temperature drops the current available decreases; at -40º F the power available is near zero
- A fully charged battery will not freeze; vehicle batteries do not receive an adequate charge unless warmed to 35º F
- Test batteries every three days; fill with 1.280 electrolyte for protection to -90º F
- Absorbent Glass Mat (AGM) batteries are generally maintenance free and are replacing older style storage batteries



Small Equipment Batteries

Small equipment batteries must be alkaline type and not dry cell.

Keep small equipment batteries in interior pockets to help keep them warm.

Nickel-cadmium type is very effective at low temperatures.

Lithium sulfur dioxide batteries are recommended for cold weather.

Generators

High failure rate often due to outdated Lubricant Orders

Use clean fuel- contaminated fuel causes generator fuel line icing

Check, drain, and clean filters daily and at shutdown

Preheat and provide a small shelter so that the generator provides its own heat

Proper grounding

Preparation for Operation and Vehicle Winterization

Conduct PMCS using TM; see operation under other than usual conditions

Wheel Bearings

Hydraulic Braking Systems; check brake reservoirs; no special lubricant required

Air Brake Systems – ensure valves are operational and that air tanks are drained to prevent condensation from forming and freezing. Check alcohol evaporator system. NMC 1 OCT-31 APR

CTIS and air compressors – same check as Air Brake systems

Steering Gear fluid reservoirs have correct fluid

Preparation for Operation and Vehicle Winterization (cont.)

Shock Absorbers
Springs
Tires
Fire Extinguishers winterized
Oil Engine Arctic (OEA)
Belts and Hoses
Thermostats
Winter Fronts or radiator shutters
Vehicle personnel heaters mounted and operated
Tire chains, SLAVE/ jumper cables, ice scrapers etc. are present

Vehicle Operation

Vehicles must be properly tuned prior to use

Heat retention devices should be installed

Allow engine to warm for at least 5 minutes prior to movement

From -20°F to -60°F, periodic starting/movement may be necessary to keep vehicles operational

Downgrade hoists and winch capacities by half

Engine idle must be as indicated in TM to maintain battery charge

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Effects of Cold on Weapons

Terminal Learning Objective

Action: Maintain weapons in cold weather

Condition: In temperatures of 32º F to -60 ºF, given assigned weapon with technical manual.

Standard: Identify common problems with weapon systems that are caused by the cold weather. Take steps to reduce or eliminate problems caused by the cold before, during, and after operations.

Weapons: Common Problems and Solutions

Sluggishness:

- **CLP (Cleaner, Lubricant Preservative) thickens in cold conditions and freezes at -35º F**
- **Lubricate with LAW (lubricating oil, weapon); if none available weapon should be fired dry**
- **Graphite lubricant is another option**

Condensation:

- **Occurs when weapons are brought into heated shelters; condensation freezes when the weapon is taken back into the cold**
- **Store weapons outside**

Weapons: Common Problems and Solutions (cont.)

Fouling from Snow and Ice

Use muzzle covers or improvise

- **Use a de-icer for frozen weapons**

Visibility

- **Ice Fog at -30º F; difficult to observe strike of rounds; gives away position**
- **Frequent position changes may be needed or observer to spot/adjust rounds**

Breakage and Malfunctions

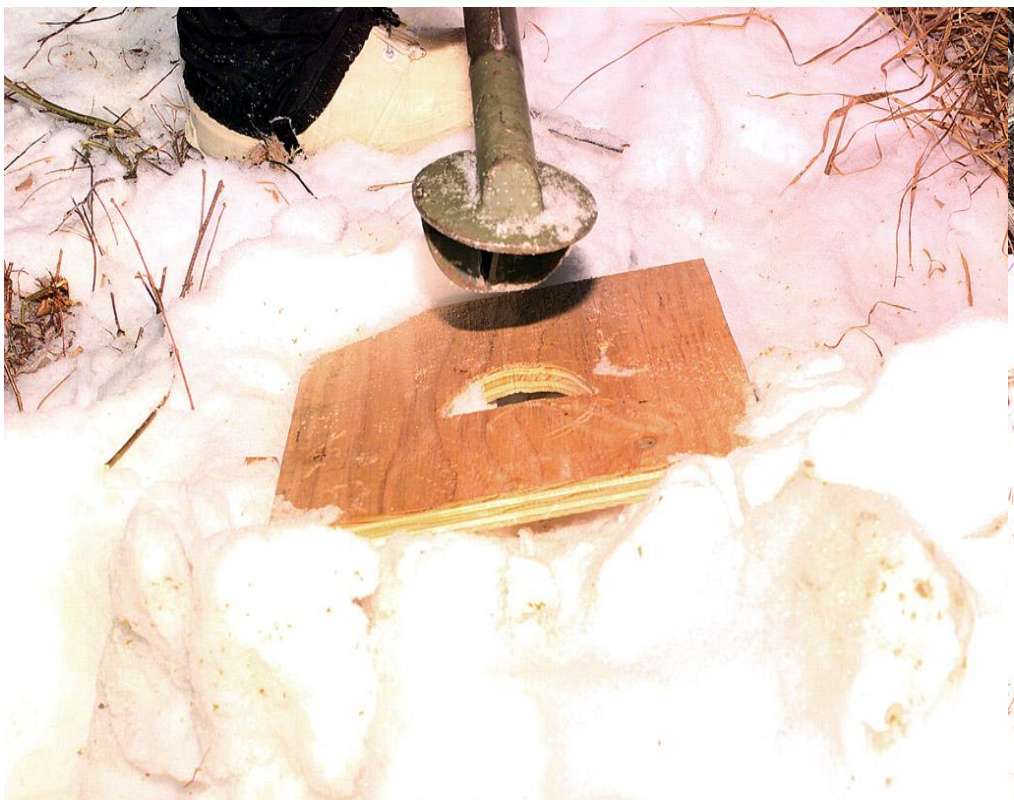
- **Extreme cold increases the chance of metal and/or plastic component failures**
- **Slow firing rates to allow the weapon to warm gradually**

Weapons: Common Problems and Solutions (cont.)

Deep snow will hamper emplacement.

Tripods may be mounted to Ahkio sleds

Plywood cutouts can be attached to tripod feet



Plywood cutouts on tripod feet

M240 mounted on scout sled

Weapons: Common Problems and Solutions (cont.)

Reduced Velocity and Range of Projectiles

As temperature drops so does muzzle velocity and thus the range of projectiles

Internal Ballistics

External Ballistics

Re-zero weapons in extreme cold conditions

Rifles and Automatic Weapons

Re-zeroing required for all weapons systems

High rate of breakage; require test firing prior to deployment.

Units must carry extra parts

Short recoil and buffer freezing causes malfunctions

Begin with slow rate of fire

MK-19

Use Lubricant, Weapon, Semi-Fluid (LSAT) or Grease, Molybdenum Disulfide (GMD) to -25º F.

Below -25F use LAW

Use cloth covers rather than plastics to protect the weapon from the elements

Mortars

Temperature below 10°F, lube with LAW

Wipe inside of bore dry before going out into the cold

Cover cartridges

Keep fire control instruments in their cases

Cushion base plate

Use anticontact gloves for dropped rounds

Baseplate not cushioned before firing

Missile Systems

The TOW and Javelin can be used down to -25 F and can be stored down to -65

Double the back-blast area of all missile systems

The Javelin will drop when fired in the extreme cold; the weapon should not be fired from defilade or reverse slope positions

Grenades and Demolitions

Smoke grenades should be deployed on a platform, hard ground or wired to a stake

Grenades may stick to gloves/mittens if either item is wet

C-4, detonation cord and time fuse may need to be re-warmed prior to use

Double hangfire and misfire waiting times

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